PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-237051

(43)Date of publication of application : 23.08.2002

(51)Int.Cl. G11B 7/0045
G11B 20/14

(21)Application number : 2002-039987

(22)Date of filing : 08.11.1995

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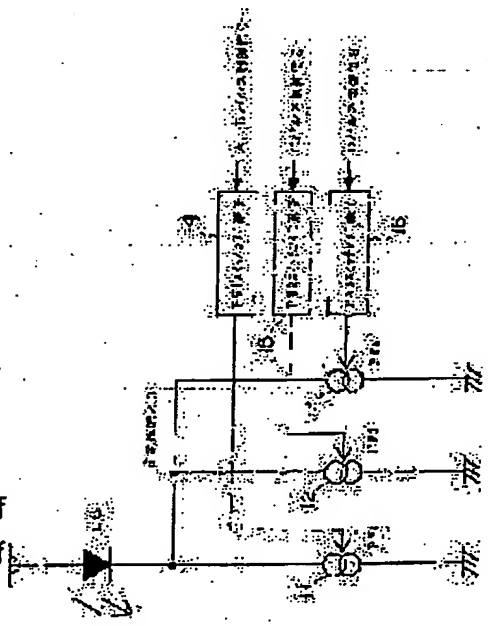
(54) INFORMATION RECORDING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To solve the problem involved in a conventional method that it is necessary to accelerate a light source drive part when performing high-speed recording while it is impossible to accurately record the mark of a prescribed length.

SOLUTION: When a plurality of recording data of a first set which includes the shortest mark length among the recording data of each mark length and has mark lengths different by 2T (T is a recording channel clock period.) from the shortest mark length are recorded, the pulse width of a rear heating pulse and the pulse width of a rear cooling pulse are made almost the same as that of the recording channel clock period.



LEGAL STATUS

[Date of request for examination] 10.04.2002

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

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CLAIMS

[Claim(s)]
[Claim 1] In case it records by the light from the light source by considering information as a mark on the record medium which has the recording layer which carries out a phase change to a crystal phase and an amorphous phase reversibly The light of a multi-pulse is made to emit light to this light source, and a record mark is formed. The light of said multi-pulse In the information recording method which consists of a head heating pulse, a tail end cooling pulse, and the posterior part cooling pulse and posterior part heating pulse that are inserted by turns between said head heating pulse and said tail end cooling pulse according to the mark length of record data The shortest mark length among the record data of each mark length the case where two or more record data of the 1st set with which 2T (T is record channel clock period) every mark length differs from the mark length of the hidden aforementioned shortest are recorded -- the pulse width of said posterior part heating pulse, and the pulse width of said posterior part cooling pulse -- said record channel clock period and abbreviation -- having presupposed that it is the same The information recording method by which it is characterized.
[Claim 2] In an information recording method according to claim 1, the width of face of said posterior part heating pulse in each record data in the case of recording two or more record data of the 2nd set of other mark length except said two or more record data of the 1st set among the record data of each of said mark length, and the width of face of said posterior part cooling pulse The information recording method characterized by setting up so that a difference with total of the pulse width of total of the pulse width of said posterior part heating pulse, said posterior part cooling pulse, and said tail end cooling pulse may serve as abbreviation identitas.
[Claim 3] In an information recording method according to claim 1 or 2, when recording said two or more record data of the 2nd set Pulse width of each posterior part cooling pulse of in front of this posterior part heating pulse and an immediately after is set to 0.75T, using as 0.5T pulse width of the posterior part heating pulse located at the core of the part which consists of said posterior part heating pulse in these record data, and said posterior part cooling pulse. The information recording method characterized by setting pulse width of each posterior part heating pulse of in front of this posterior part cooling pulse and an immediately after to 0.75T, having used as 0.5T pulse width of the posterior part cooling pulse located at the core of the part which consists of said posterior part heating pulse in said record data, and said posterior part cooling pulse.
[Claim 4] In an information recording method according to claim 1 or 2, when recording said two or more record data of the 2nd set Pulse width of each posterior part heating pulse of in front of this posterior part cooling pulse and an immediately after is set to 1.25T, using as 1.5T pulse width of the posterior part cooling pulse located at the core of the part which consists of said posterior part heating pulse in these record data, said posterior part cooling pulse, and said tail end cooling pulse. Pulse width of the posterior part heating pulse located at the core of the part which consists of said posterior part heating pulse in said record data, said posterior part cooling pulse, and said tail end cooling pulse is set to 1.5T. The information recording method characterized by setting pulse width of each posterior part cooling pulse of in front of this posterior part heating pulse and an immediately after to 1.25T.

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[Claim 5] The information recording method characterized by amending one of the heating pulses or cooling pulses for a light-emitting part of said posterior part heating pulse in these record data, said posterior part cooling pulse, and said tail end cooling pulse in an information recording method according to claim 1, 2, 3, or 4 when said two or more record data of the 2nd set are recorded.
[Claim 6] The information recording method characterized by said recording layer consisting of a record ingredient of an AgInSbTe system in an information recording method according to claim 1, 2, 3, 4, or 5.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the information recording method which records information by the light from the light source on the record medium which has the recording layer which carries out a phase change to a crystal phase and an amorphous phase reversibly.
[0002]
[Description of the Prior Art] The media only for playbacks (record medium) and information regenerative apparatus, such as CD for music and CD-ROM, are put in practical use with the spread of multimedia. Recently, phase change mold media also attract attention besides the write once optical disk which used coloring matter media, and the rewritable MO disk using optical MAG (MO) media. These phase change mold media carry out the phase change of the record ingredient to a crystal phase and an amorphous phase reversibly, and record information. Moreover, the over-writing record to which informational record and playback are made only in the laser beam from the light source which does not need an external magnetic field unlike MO media etc., but consists of semiconductor laser, and informational record and elimination are carried out at once by the laser beam is possible for phase change mold media. Semiconductor laser is driven by the semiconductor laser drive circuit here.
[0003] Although there is a semiconductor laser luminescence wave of the single pulse generated based on the EFM (Eight Fourteen Modulation) modulation code etc. as a general record wave for recording information on phase change mold media as shown in drawing 7 In this record wave, a record mark produces distortion in the shape of a tear with the accumulated heat, or a cooling rate is insufficient for phase change mold media, and it becomes inadequate forming [of an amorphous phase] them, and they have problems -- the record mark of a low reflection factor is not obtained to a laser beam.
[0004] Then, the above-mentioned problem is prevented by forming a mark in phase change mold media by the laser beam of multi-pulse shape which used the multistage record power generated based on the eight-to-fourteen modulation code etc. as the conventional information recording method which records information on phase change mold media was shown in drawing 8 . The head heating pulse A for the mark section of this multi-pulse shape to fully carry out preheating of the record film of phase change mold media beyond melting point temperature It consists of a cooling pulse C by which the heating pulse B which the plurality which follows followed was followed between these. In PWA and the luminescence power of the heating pulse B, PWB and the luminescence power of the cooling pulse C are set by PWC, and lead power is set [power / of the head heating pulse A / luminescence] as PR, then PWB>=PWA>PWC**PR.
[0005] The IRESU section of multi-pulse shape consists of an IRESU pulse D, and the luminescence power PED is set as PWA<PED<PWC. Thus, by using a record wave as multi-pulse shape, an amorphous phase is formed as the mark section of the quenching conditions of heating -> cooling, a crystal phase is formed as the tooth-space section of the gradual cooling conditions of only heating, and, as for phase change mold media, sufficient reflection factor difference is acquired by the amorphous phase and the crystal phase.

[0006] Moreover, although there are a mark position (PPM) recording method and a mark edge (PWM:Pulse Width Modulation) recording method as an information recording method, recently, the mark edge recording method which can respond to densification is used. When information was recorded on phase change mold media by the mark edge recording method, the heating pulse and cooling pulse which have the pulse width of 0.5T to the period T based on a record channel clock were used.

[0007] That is, whenever the mark length of record data increased 1T, the light adding 1 set of heating pulses and a cooling pulse of a multi-pulse was used. Drawing 9 shows the typical record wave. Since this record wave can always record the record data of different mark length on certain heating cooling conditions, the edge shift depending on the mark length of record data is reduced. Moreover, when performing high-speed record by this record wave, a record wave remains as it is and has RF-ized the record channel clock for record linear velocity and this scale factor like twice and 4 times.

[0008] The optical information recording device which only predetermined time delays the standup or falling of a record signal, and negated change of the duty ratio of the detecting signal at the time of playback is indicated by JP,62-11412,A. Moreover, when recording data on a phase-change optical disk, after raising the power level of a laser beam to the record power which record film fuses from the crystallization power of the record film of a phase-change optical disk, the optical record approach of the information which power level lower than crystallization power is made to reduce in an instant is indicated by JP,5-32811,A.

[0009]

[Problem(s) to be Solved by the Invention] When recording information on phase change mold media by the mark edge recording method, it is important for phase change mold media to perform heating and quenching sufficient in a record mark formation part, and to form the edge section before and after a mark vividly. However, when performing high-speed record, since the record channel clock was RF-ized for record linear velocity and this scale factor like twice and 4 times, it was difficult [it / the record wave remained as it was, and] for the width of face of a heating pulse and a cooling pulse to become very small, and to obtain attainment temperature and a cooling rate required for layer change of record film. For this reason, forming [of a mark] became inadequate and the mark of exact mark length was not obtained.

[0010] Moreover, since a provincial accent will arise [when performing high-speed record] in a record wave as shown in drawing 10 (a) when recording the mark of 9T, for example if the build up time of a semiconductor laser drive circuit and falling time amount become large to a record channel clock, it becomes impossible for phase change mold media to perform sufficient heating and sufficient cooling, and the problem that a record mark becomes short has produced them. Mark length is extremely short as the RF signal (eye pattern) as a regenerative signal acquired at this time is shown in drawing 10 (b) and a record data length becomes long. Therefore, at the time of high-speed record, high-speed response-ization of a semiconductor laser drive circuit was needed, the circuit became large-scale and high cost-ization was caused.

[0011] This invention can obtain predetermined record mark length, without being able to secure sufficient heating time and a sufficient cooldown delay, and accelerating a light source mechanical component, and aims at offering the information recording method which becomes possible [performing high-speed record].

[0012]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, invention according to claim 1 In case it records by the light from the light source by considering information as a mark on the record medium which has the recording layer which carries out a phase change to a crystal phase and an amorphous phase reversibly The light of a multi-pulse is made to emit light to this light source, and a record mark is formed. The light of said multi-pulse In the information recording method which consists of a head heating pulse, a tail end cooling pulse, and the posterior part cooling pulse and posterior part heating pulse that are inserted by turns between said head heating pulse and said tail end cooling pulse according to the mark length of record data The shortest mark length among the record data of each

mark length the case where two or more record data of the 1st set with which 2T (T is record channel clock period) every mark length differs from the mark length of the hidden aforementioned shortest are recorded -- the pulse width of said posterior part heating pulse, and the pulse width of said posterior part cooling pulse -- said record channel clock period and abbreviation -- suppose that it is the same.

[0013] Invention according to claim 2 is set to an information recording method according to claim 1. The width of face of said posterior part heating pulse in each record data in the case of recording two or more record data of the 2nd set of other mark length except said two or more record data of the 1st set among the record data of each of said mark length, and the width of face of said posterior part cooling pulse It sets up so that a difference with total of the pulse width of total of the pulse width of said posterior part heating pulse, said posterior part cooling pulse, and said tail end cooling pulse may serve as abbreviation identitas.

[0014] Invention according to claim 3 is set to an information recording method according to claim 1 or 2. When recording said two or more record data of the 2nd set Pulse width of each posterior part cooling pulse of in front of this posterior part heating pulse and an immediately after is set to 0.75T, using as 0.5T pulse width of the posterior part heating pulse located at the core of the part which consists of said posterior part heating pulse in these record data, and said posterior part cooling pulse. Pulse width of each posterior part heating pulse of in front of this posterior part cooling pulse and an immediately after is set to 0.75T, using as 0.5T pulse width of the posterior part cooling pulse located at the core of the part which consists of said posterior part heating pulse in said record data, and said posterior part cooling pulse.

[0015] Invention according to claim 4 is set to an information recording method according to claim 1 or 2. When recording said two or more record data of the 2nd set Pulse width of each posterior part heating pulse of in front of this posterior part cooling pulse and an immediately after is set to 1.25T, using as 1.5T pulse width of the posterior part cooling pulse located at the core of the part which consists of said posterior part heating pulse in these record data, said posterior part cooling pulse, and said tail end cooling pulse. Pulse width of each posterior part cooling pulse of in front of this posterior part heating pulse and an immediately after is set to 1.25T, using as 1.5T pulse width of the posterior part heating pulse located at the core of the part which consists of said posterior part heating pulse in said record data, said posterior part cooling pulse, and said tail end cooling pulse.

[0016] In an information recording method according to claim 1, 2, 3, or 4, invention according to claim 5 amends one of the heating pulses or cooling pulses for a light-emitting part of said posterior part heating pulse in these record data, said posterior part cooling pulse, and said tail end cooling pulse, when recording said two or more record data of the 2nd set.

[0017] As for invention according to claim 6, said recording layer consists of a record ingredient of an AgInSbTe system in an information recording method according to claim 1, 2, 3, 4, or 5.

[0018]

[Embodiment of the Invention] Drawing 1 shows a part of example adapting invention according to claim 1 to 3 of an information record regenerative apparatus, and drawing 2 shows the timing chart. This information record regenerative apparatus is the example of the information record regenerative apparatus which records the code data of a CD-ROM format on the phase change mold media of a phase-change optical disk (over-writing), and performs mark edge (PWM) record using an eight-to-fourteen modulation code.

[0019] This information record regenerative apparatus generates a pulse control signal based on EFM data in the control means on the strength [optical] which consists of a digital circuit which is not illustrated at the time of record. The light of a multi-pulse as driven the light source which consists of semiconductor laser LD of an optical head according to the drive current according to the pulse control signal in a semiconductor laser drive circuit and shown in drawing 2 is made to emit light. A record mark is formed in phase change mold media by rotating a phase-change optical disk with a spindle motor, and irradiating the light of the multi-pulse from semiconductor laser LD through optical system at the phase change mold media of a phase-change optical disk with an optical head, and information is recorded.

[0020] Moreover, at the time of playback, this information record regenerative apparatus drives semiconductor laser LD in a semiconductor laser drive circuit, is made to emit light by playback power (lead power), irradiates the light of the playback power from semiconductor laser LD through optical system at phase change mold media with an optical head, carries out photo electric conversion of that reflected light with a light-receiving means through optical system, and acquires a regenerative signal. The light of the multi-pulse by which outgoing radiation is carried out from semiconductor laser LD at the time of record is the light of the multi-pulse which consists of a posterior part cooling pulse C by which the posterior part heating pulse B by which the plurality which follows followed the head heating pulse A was followed between these. However, the luminescence power of the head heating pulse A and the luminescence power of the posterior part heating pulse B suppose that it is the same.
[0021] As a semiconductor laser drive circuit shows semiconductor laser LD of the above-mentioned optical head to drawing 1 , the constant current which is equivalent to the luminescence power of the head heating pulse A and the luminescence power of the posterior part heating pulse B from a constant current source 11 is supplied, the constant current which is equivalent to the luminescence power of the cooling pulse C from a constant current source 12 is supplied, and the constant current which is equivalent to the luminescence power of the IRESU pulse D from a constant current source 13 is supplied.
[0022] Switching elements 14-16 are made to emit light by the multi-pulse as shows semiconductor laser LD to drawing 2 by making constant current sources 11-13 turn on / turn off with the A+B pulse control signal from a control means on the strength [optical], and a C pulse control signal D pulse control signal, respectively by the control means on the strength [optical] which is not illustrated generating an A+B pulse control signal, C pulse control signal, and D pulse control signal based on EFM data.
[0023] This information record regenerative apparatus records record data on phase change mold media by the **** record wave shown to drawing 2 that exact mark length is obtained, even if a record channel clock serves as a high frequency by high-speed record. The light of the multi-pulse by which outgoing radiation is carried out from semiconductor laser LD As shown in drawing 2 , in recording the mark of 3T (T is the period of a record channel clock) which are the shortest mark length, the pulse width of the head heating pulse A 1.5T, Other odd number length [as opposed to / are setting pulse width of the tail end cooling pulse Cr to 1T, and / the period T of a record channel clock] (5T) In recording the mark which has the die length of 7T, 9T, and 11T, it has set up so that only the predetermined group from which the cooling pulse C which has the pulse width of 1T, and the heating pulse B which has the pulse width of 1T differ mutually may continue between the head heating pulse A and the tail end cooling pulse Cr, respectively. For this reason, the accumulation length of a record wave is set to n-0.5T.
[0024] Moreover, when recording the mark which has the die length of other even number length (4T, 6T, 8T, 10T) to the period T of a record channel clock, the record wave is set up under a different regulation from the case where the mark which has the die length of odd number length is recorded. In recording the mark which has the die length of 4T and 8T, pulse width of the heating pulse B located at the core of the consecutiveness part except the head heating pulse A is set to 0.5T, pulse width of the cooling pulse C before and behind this heating pulse B is set to 0.75T, and it is setting pulse width of the other heating pulses B and the cooling pulse C to 1T.
[0025] In recording the mark which has the die length of 6T and 10T, pulse width of the cooling pulse C located at the core of the consecutiveness part except the head heating pulse A is set to 0.5T, pulse width of the heating pulse B before and behind this cooling pulse C is set to 0.75T, and it is setting pulse width of the other heating pulses B and the cooling pulse C to 1T. Thus, by setting up a record wave, as shown in drawing 3 (a), the width of face of the heating pulse equivalent to the edge section before and behind a mark and a cooling pulse becomes large enough, and the luminescence wave of semiconductor laser LD can stop the jitter of a regenerative signal.
[0026] Moreover, the accumulation length of a heating pulse and a cooling pulse is set to the n(n: integer)-0.5T [same] by the mark which has the die length of odd number length to record channel clock period T, and the mark which has the die length of even number length, an edge shift does not

arise by the mark which has the die length of odd number length, and the mark which has the die length of even number length, and all mark length has become the integral multiple of 1T. Moreover, the mark median in the mark which has the die length of even number length serves as pulse width of 0.5T, and although mark formation is not enough, even if the mark has become thin in PWM record, there is no effect in a regenerative signal.

[0027] Since the control means on the strength [optical] which consists of a digital circuit makes the light of the above multi-pulses emit light by generating a pulse control signal based on EFM data, and making a semiconductor laser drive circuit drive semiconductor laser LD with the drive current according to the pulse control signal, a control means on the strength [optical] serves as simple circuitry, and it can constitute a semiconductor laser drive circuit from a low cost circuit easily. Moreover, the control means on the strength [optical] which consists of a digital circuit can use the synchronous circuit which generates a pulse control signal based on EFM data synchronizing with a record channel clock and the clock of the twice as many frequency as this, as shown in drawing 2 , and it can obtain very exact pulse width.

[0028] The RF signal (eye pattern) which is a regenerative signal as the mark recorded on phase change mold media with this information record regenerative apparatus becomes possible [forming in an exact mark equal to an EFM data length] and it is shown in drawing 3 (b) is good like the time of performing low-speed record.

[0029] In addition, the set points, such as pulse width of the head heating pulse A and pulse width of the tail end cooling pulse Cr, show the typical value, and should be just adapted in the value optimized by the record ingredient, the media phase configuration, etc. in fact. Moreover, since the accumulation length of a record wave differs from the die length of a formation mark according to the difference in a record modulation technique, or the path of the optical spot by the laser beam on recording density and media, a setup of the record wave in the record data which have the die length of even number length to a record channel clock period, and the record data which have the die length of odd number length may be replaced.

[0030] Thus, this information record regenerative apparatus is the example of the information record regenerative apparatus adapting invention according to claim 1. In case information is recorded by the light from semiconductor laser LD as the light source on the record medium which has the recording layer which carries out a phase change to a crystal phase and an amorphous phase reversibly In the information recording method which the light of the multi-pulse which becomes this light source LD from the head heating pulse A, and two or more posterior part heating pulses B, posterior part cooling pulses C and tail end cooling pulses Cr which follow is made to emit light, and forms a record mark Since pulse width of the posterior part heating pulse B and the posterior part cooling pulse C was made into a record channel clock period and abbreviation identitas when the record data of either mark length of the even number length to record channel clock period T and odd number length were recorded Sufficient heating time and a sufficient cooldown delay are securable, predetermined record mark length can be obtained correctly, without accelerating the semiconductor laser drive circuit as a light source mechanical component, and it becomes possible to perform high-speed record.

[0031] Moreover, this information record regenerative apparatus is the example of the information record regenerative apparatus adapting invention according to claim 2. Said even number length When recording the record data of the mark length of another side to one mark length of the odd number length, the difference of total of cooling pulse width and total of heating pulse width in a part for the light-emitting part of the posterior part heating pulse B, the posterior part cooling pulse C, and the tail end cooling pulse Cr receives record channel clock period T. Since the width of face of the posterior part heating pulse B and the width of face of the posterior part cooling pulse C were set up so that the record data of even number length and the record data of odd number length might make abbreviation identitas Predetermined record mark length can be obtained correctly, without [without an edge shift produces the record data of even number length, and the record data of odd number length, and] accelerating the semiconductor laser drive circuit as a light source mechanical component, and it becomes possible to perform high-speed record.

[0032] Moreover, this information record regenerative apparatus is the example of the information record regenerative apparatus adapting invention according to claim 3. The heating pulse located at the core for a light-emitting part of said posterior part heating pulse and said posterior part cooling pulse when recording the record data of the mark length of another side to one mark length of said even number length and odd number length, Since width of face of a cooling pulse and a heating pulse or a cooling pulse, a heating pulse, and a cooling pulse was set to 0.75T, 0.5T, and 0.75T Pulse width of the heating pulse equivalent to the edge section before and behind a mark and a cooling pulse can be enlarged enough, the clear edge section can be formed, and it becomes possible to stop the jitter of a regenerative signal.

[0033] Drawing 4 shows claims 1 and 2 and the timing adapting invention of four publications of an example of an information record regenerative apparatus of operation. It differs from the example of the information record regenerative apparatus to which this information record regenerative apparatus records by having constituted the multi-pulse luminescence wave so that exact mark length may be obtained, and invention of the one to claim 3 above-mentioned publication was applied fundamentally, and the example of the information record regenerative apparatus to which the following points applied invention of the one to claim 3 above-mentioned publication although it was the same.

[0034] In this information record regenerative apparatus, the luminescence wave of the above-mentioned multi-pulse is set as the same wave as the example of the information record regenerative apparatus adapting invention of the one to claim 3 above-mentioned publication, when recording the mark which has the die length of odd number length (3T, 5T, 7T, 9T, 11T) to the period T of a record channel clock, as shown in drawing 4 . Therefore, the accumulation length of a record wave is set to n-0.5T. That is, the above-mentioned control means on the strength [optical] is made to emit light by the multi-pulse as shows semiconductor laser LD to drawing 4 according to generating an A+B pulse control signal, C pulse control signal, and D pulse control signal based on EFM data, and making switching elements 14-16 turn on / turn off constant current sources 11-13 with the A+B pulse control signal, C pulse control signal D, and a pulse control signal.

[0035] Moreover, when recording the mark which has the die length of other even number length (4T, 6T, 8T, 10T) to the period T of a record channel clock, the record wave is set up under a different regulation from the case where the mark which has the die length of odd number length is recorded. Since it generates the cooling pulse C+ heating pulse B+ cooling pulse C among 2T in recording the mark which has the die length of 4T, the record wave has been set as the same record wave as the example of the information record regenerative apparatus adapting invention of the one to claim 3 above-mentioned publication.

[0036] In recording the mark which has the die length of 6T and 10T, pulse width of the heating pulse B located at the core of the consecutiveness part except the head heating pulse A is set to 1.5T, pulse width of the cooling pulse C before and behind this heating pulse B is set to 1.25T, and it is setting pulse width of the other heating pulses B and the cooling pulse C to 1T. In recording the mark which has the die length of 8T, pulse width of the cooling pulse C located at the core of the consecutiveness part except the head heating pulse A is set to 1.5T, pulse width of the heating pulse B before and behind this cooling pulse C is set to 1.25T, and it is setting pulse width of the other heating pulses B and the cooling pulse C to 1T.

[0037] Thus, by setting up a record wave, the pulse width of the heating pulse equivalent to the edge section before and behind a mark and a cooling pulse becomes large enough, the edge of a mark comes to be formed vividly, and the luminescence wave of semiconductor laser LD can stop the jitter of a regenerative signal. Moreover, the accumulation length of a heating pulse and a cooling pulse is set to the n-0.5T [same] by the mark which has the die length of odd number length, and the mark which has the die length of even number length, an edge shift does not arise by the mark which has the die length of odd number length, and the mark which has the die length of even number length, and all mark length has become the integral multiple of 1T. Moreover, the mark median in the mark which has the die length of even number length serves as pulse width beyond 1.25T, heating and cooling with sufficient phase change mold media are performed, and a mark does not become thin. Therefore, a mark has an ideal

configuration from the example of the information record regenerative apparatus adapting invention of the one to claim 3 above-mentioned publication.

[0038] In addition, the set points, such as pulse width of the head heating pulse A and pulse width of the tail end cooling pulse Cr, show the typical value, and should be just adapted in the value optimized by the record ingredient, the media phase configuration, etc. in fact. Moreover, since the accumulation length of a record wave differs from the die length of a formation mark according to the difference in a record modulation technique, or the path of the optical spot by the laser beam on recording density and media, a setup of the record wave in the record data of even number length and the record data of odd number length may be replaced.

[0039] Thus, this information record regenerative apparatus is the example of claim 1 and the information record regenerative apparatus adapting invention of two publications as well as the example of the information record regenerative apparatus adapting invention of the one to claim 3 above-mentioned publication, and the same effectiveness is acquired.

[0040] Moreover, this information record regenerative apparatus is the example of the information record regenerative apparatus adapting invention according to claim 4. The heating pulse B located at the core for a light-emitting part of the posterior part heating pulse A, the posterior part cooling pulse C, and the tail end cooling pulse Cr when recording the record data of the mark length of another side to one mark length of said even number length and odd number length Since pulse width of the cooling pulse C and the heating pulse B or the cooling pulse C, the heating pulse B, and the cooling pulse C was set to 1.25T, 1.5T, and 1.25T, also in a mark center section, it becomes sufficient heating pulse width and cooling pulse width, and a mark does not become thin. Therefore, it becomes possible to stop the jitter of a regenerative signal more.

[0041] Drawing 5 shows the timing of an example adapting invention according to claim 5 of an information record regenerative apparatus of operation. Although this information record regenerative apparatus is fundamentally the same as the example of the information record regenerative apparatus adapting invention of the one to claim 3 above-mentioned publication, the following points differ from the example of the information record regenerative apparatus adapting invention of the one to claim 3 above-mentioned publication.

[0042] In the information record regenerative apparatus adapting invention of the one to claim 3 above-mentioned publication In a record wave, by the record mark which has the die length of even number length, and the record mark which has the die length of odd number length Since the regularity of heating pulse width and cooling pulse width differs, a gap arises on some heating cooling conditions, and when based on the record mark which has the die length of odd number length, an edge shift occurs to the record mark which has the die length of even number length. Since the detection width of window Tw of a regenerative signal becomes small as recording density becomes large, an error comes to arise to data by the edge shift.

[0043] So, in this information record regenerative apparatus, amendment of the above-mentioned multi-pulse luminescence wave is performed so that generating of such an edge shift may be prevented and an error can be reduced. The record wave over the record mark of odd number length and even number length is the same as the example of the information record regenerative apparatus adapting invention of the one to claim 3 above-mentioned publication. All the pulse width of heating pulses other than the head heating pulse A and a cooling pulse of the record wave over the record mark of odd number length is 1T, and an edge shift is not produced between each mark of 3T, 5T, 7T, 9T, and 11T.

[0044] Therefore, with this information record regenerative apparatus, the record wave over the record mark of even number length with each irregular mark length performs the following amendments in the control means on the strength [optical] which consists of a digital circuit. First, since the pulse width of the heating pulse B located at the core of the consecutiveness part except the head heating pulse A is not pulse width sufficient at the time of high-speed record by 0.5T, an edge shift which becomes short to the record mark of odd number length produces the record wave over the record mark which has the die length of 4T and 8T.

[0045] so, in recording the mark which has the die length of 4T and 8T in this information record

regenerative apparatus The pulse width of the heating pulse B located at the core of the consecutiveness part except the head heating pulse A as the control means on the strength [optical] which consists of a digital circuit, respectively shows to drawing 5 is amended so that only the time amount alpha4 and alpha8 equivalent to an edge shift amount may become large. The thing of each pulse width of 0.5 T+alpha 4 and 0.5 T+alpha 8 is generated as a heating pulse B located at the core of the consecutiveness part except the head heating pulse A, and the thing of the pulse width of 0.75T is generated as a cooling pulse C before and behind this heating pulse B.

[0046] Moreover, since the pulse width of the cooling pulse C located at the core of the consecutiveness part except the head heating pulse A is not pulse width sufficient at the time of high-speed record by 0.5T, an edge shift to which a back edge becomes short to the record mark which has the die length of odd number length produces the record wave over the record mark which has the die length of 6T and 10T.

[0047] so, in recording the mark which has the die length of 6T and 10T in this information record regenerative apparatus The pulse width of the cooling pulse C located at the core of the consecutiveness part except the head heating pulse A in the control means on the strength [optical] which consists of a digital circuit, respectively is amended so that only the time amount alpha6 and alpha10 equivalent to an edge shift amount may become large. The thing of each pulse width of 0.5 T+alpha 6 and 0.5 T+alpha 10 is generated as a cooling pulse C located at the core of the consecutiveness part except the head heating pulse A, and the thing of the pulse width of 0.75T is generated as a heating pulse B before and behind this cooling pulse C.

[0048] By carrying out such amendment, an edge shift by the mark which has the die length of odd number length, and the mark which has the die length of even number length is amended completely, and the high density record of it is attained more. moreover -- since the pulse width of the heating pulse B located at the core of the consecutiveness part except the head heating pulse A as mentioned above and the cooling pulse C is amended so that it may both become large -- the core of a record mark -- also becoming thin -- it can improve and a better regenerative signal is acquired.

[0049] In addition, the set point of a record wave shows the typical value, and should be just adapted in the value optimized by the record ingredient, the media phase configuration, etc. in fact. Moreover, since the accumulation length of a record wave differs from the die length of a formation mark according to the difference in a record modulation technique, or the path of the optical spot by the laser beam on recording density and media, a setup of the record wave in the record data of even number length and the record data of odd number length may be replaced.

[0050] Moreover, since it depends on the accumulation length of a heating pulse and a cooling pulse for the die length of the record mark formed, the same effectiveness as **** is acquired by amending an edge shift amount to the accumulation length. Therefore, except what is located at the core of the consecutiveness part except the head heating pulse A is sufficient as the heating pulse and cooling pulse to amend, for example, they may be made to amend an edge shift amount to the pulse width of the tail end cooling pulse Cr. Moreover, in the control means on the strength [optical] which consists of a digital circuit, delay circuits, such as a delay line of a multiple tap and two or more mono-multivibrators, can constitute easily a means to generate the heating pulse and cooling pulse which were amended with a sufficient precision multistage.

[0051] Thus, it is the example of the information record regenerative apparatus to which invention according to claim 5 was applied in this information record regenerative apparatus. Since one of the heating pulses or cooling pulses for a light-emitting part of the posterior part heating pulse B, the posterior part cooling pulse C, and the tail end cooling pulse Cr were amended when the record data which have the die length of the mark length of another side to one mark length of said even number length and odd number length were recorded It becomes possible to amend completely some edge shift by the difference among the heating cooling conditions of the media in the record data which have the die length of even number length, and the record data which have the die length of odd number length. In addition, invention according to claim 5 is applicable also like the example of above-mentioned claims 1 and 2 and the information record regenerative apparatus adapting invention of four

publications.
[0052] Next, the example of the information record regenerative apparatus adapting invention according to claim 6 is explained. As a recording layer of phase change mold media used from the former, there are a germanium-Sb-Te system, a germanium-Te-Sb-S system, a Te-germanium-Sn-Au system, a germanium-Te-Sn system, a Sb-Se system, a Sb-Se-Te system, a Sn-Se-Te system, a Ga-Se-Te system, a Ga-Se-Te-germanium system, an In-Se system, an In-Se-Te system, an Ag-In-Sb-Te system, etc.
[0053] Each example of the information record regenerative apparatus adapting invention according to claim 6 In the example of the information record regenerative apparatus adapting invention of the one to claim 3 above-mentioned publication, above-mentioned claims 1 and 2 and the example of the information record regenerative apparatus adapting invention of four publications, and the example of the information record regenerative apparatus adapting above-mentioned invention according to claim 5 The record ingredient of an Ag-In-Sb-Te system is used as a recording layer of phase change mold media. When recording data on the phase change mold media which have such a recording layer, since the dependency of amorphous phase formation is high, formation of a mark is greatly influenced by the size of the difference of the luminescence power of the heating pulse for forming a mark, and the cooling pulse just behind that to the quenching conditions by heating -> cooling. Therefore, compared with the example of the information record regenerative apparatus adapting invention of the one to claim 3 above-mentioned publication, above-mentioned claims 1 and 2 and the example of the information record regenerative apparatus adapting invention of four publications, and the example of the information record regenerative apparatus adapting above-mentioned invention according to claim 5, a mark comes to be recorded vividly and can stop the jitter of a regenerative signal.
[0054] Moreover, as shown in drawing 6 , the inclination for it to be almost in agreement with a straight line has the relation between the accumulation length of a heating pulse and a cooling pulse, and formation mark length, and it can perform easily making the die length of all marks into the integral multiple of 1T, without producing an edge shift by the record data which have the die length of even number length, and the record data which have the die length of odd number length. Moreover, precision of the amendment can be made very high also to some edge shift. In addition, since the relation between a record wave and the jitter property of a regenerative signal and the relation between the pulse width of a heating pulse and a cooling pulse and mark length are fundamentally the same when other record ingredients are used for the above-mentioned recording layer, it cannot be overemphasized that this invention is effective.
[0055] Thus, the example of the information record regenerative apparatus adapting invention according to claim 6 Since a recording layer consists of a record ingredient of an AgInSbTe system, the relation between the accumulation length of the heating pulse in a record wave and a cooling pulse and formation mark length is almost in agreement with a straight line. It becomes possible to make precision of the amendment very high also to some edge shift, without producing an edge shift by the record data which have the die length of even number length, and the record data which have the die length of odd number length.
[0056]
[Effect of the Invention] In case information is recorded by the light from the light source as mentioned above on the record medium which has the recording layer which carries out a phase change to a crystal phase and an amorphous phase reversibly according to invention according to claim 1 In the information recording method which the light of the multi-pulse which becomes this light source from a head heating pulse, two or more posterior part heating pulses which follow, a posterior part cooling pulse, and a tail end cooling pulse is made to emit light, and forms a record mark Since pulse width of said posterior part heating pulse and said posterior part cooling pulse was made into a record channel clock period and abbreviation identitas when the record data of either mark length of the even number length to record channel clock period T and odd number length were recorded Sufficient heating time and a sufficient cooldown delay are securable, predetermined record mark length can be obtained correctly, without accelerating a light source mechanical component, and it becomes possible to perform high-speed record.

[0057] According to invention according to claim 2, it sets to an information recording method according to claim 1. Said even number length To one mark length of the odd number length The record data of the receiving mark length of another side So that the difference of total of cooling pulse width and total of heating pulse width in a part for the light-emitting part of said posterior part heating pulse, said posterior part cooling pulse, and said tail end cooling pulse may serve as abbreviation identitas by the record data of even number length, and the record data of odd number length, when recording Since the width of face of said posterior part heating pulse and the width of face of said posterior part cooling pulse were set up Predetermined record mark length can be obtained correctly, without [without an edge shift produces the record data which have the die length of even number length and the record data which have the die length of odd number length, and] accelerating a light source mechanical component, and it becomes possible to perform high-speed record.

[0058] According to invention according to claim 3, it sets to an information recording method according to claim 1 or 2. The heating pulse located at the core for a light-emitting part of said posterior part heating pulse and said posterior part cooling pulse when recording the record data of the mark length of another side to one mark length of said even number length and odd number length, Since width of face of a cooling pulse and a heating pulse or a cooling pulse, a heating pulse, and a cooling pulse was set to 0.75T, 0.5T, and 0.75T Pulse width of the heating pulse equivalent to the edge section before and behind a mark and a cooling pulse can be enlarged enough, the clear edge section can be formed, and it becomes possible to stop the jitter of a regenerative signal.

[0059] According to invention according to claim 4, it sets to an information recording method according to claim 1 or 2. The heating pulse located at the core for a light-emitting part of said posterior part heating pulse, said posterior part cooling pulse, and said tail end cooling pulse when recording the record data of the mark length of another side to one mark length of said even number length and odd number length, Since width of face of a cooling pulse and a heating pulse or a cooling pulse, a heating pulse, and a cooling pulse was set to 1.25T, 1.5T, and 1.25T, also in a mark center section, it becomes sufficient heating pulse width and cooling pulse width, and a mark does not become thin. Therefore, it becomes possible to stop the jitter of a regenerative signal more.

[0060] According to invention according to claim 5, it sets to an information recording method according to claim 1, 2, 3, or 4. Since one of the heating pulses or cooling pulses for a light-emitting part of said posterior part heating pulse, said posterior part cooling pulse, and said tail end cooling pulse were amended when the record data of the mark length of another side to one mark length of said even number length and odd number length were recorded It becomes possible to amend completely some edge shift by the difference among the heating cooling conditions of the media in the record data of even number length, and the record data of odd number length.

[0061] Since said recording layer consists of a record ingredient of an AgInSbTe system in an information recording method according to claim 1, 2, 3, 4, or 5 according to invention according to claim 6 The relation between the accumulation length of the heating pulse in a record wave and a cooling pulse and formation mark length is almost in agreement with a straight line. It becomes possible to make precision of the amendment very high also to some edge shift, without producing an edge shift by the record data which have the die length of even number length, and the record data which have the die length of odd number length.

[Translation done.]

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3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing a part of example adapting invention according to claim 1 to 3 of an information record regenerative apparatus.
[Drawing 2] It is the timing chart which shows the timing of this equipment of operation.
[Drawing 3] It is a wave form chart for explaining this equipment.
[Drawing 4] It is the timing chart which shows claims 1 and 2 and the timing adapting invention of four publications of an example of an information record regenerative apparatus of operation.
[Drawing 5] It is the timing chart which shows the timing of an example adapting invention according to claim 5 of an information record regenerative apparatus of operation.
[Drawing 6] It is the property Fig. showing the relation between the accumulation length of the heating pulse in the example of the information record regenerative apparatus adapting invention according to claim 6, and a cooling pulse, and formation mark length.
[Drawing 7] It is drawing showing the example of the record data in the conventional information recording method, a record wave, and a record mark.
[Drawing 8] It is drawing showing the example of the record data in other conventional information recording methods, a record wave, and a record mark.
[Drawing 9] It is the wave form chart showing the record wave over each record data in a sympathy news recording method.
[Drawing 10] It is drawing for explaining a sympathy news recording method.
[Description of Notations]
LD Laser diode
11-13 Current source
14-16 Switching element

[Translation done.]

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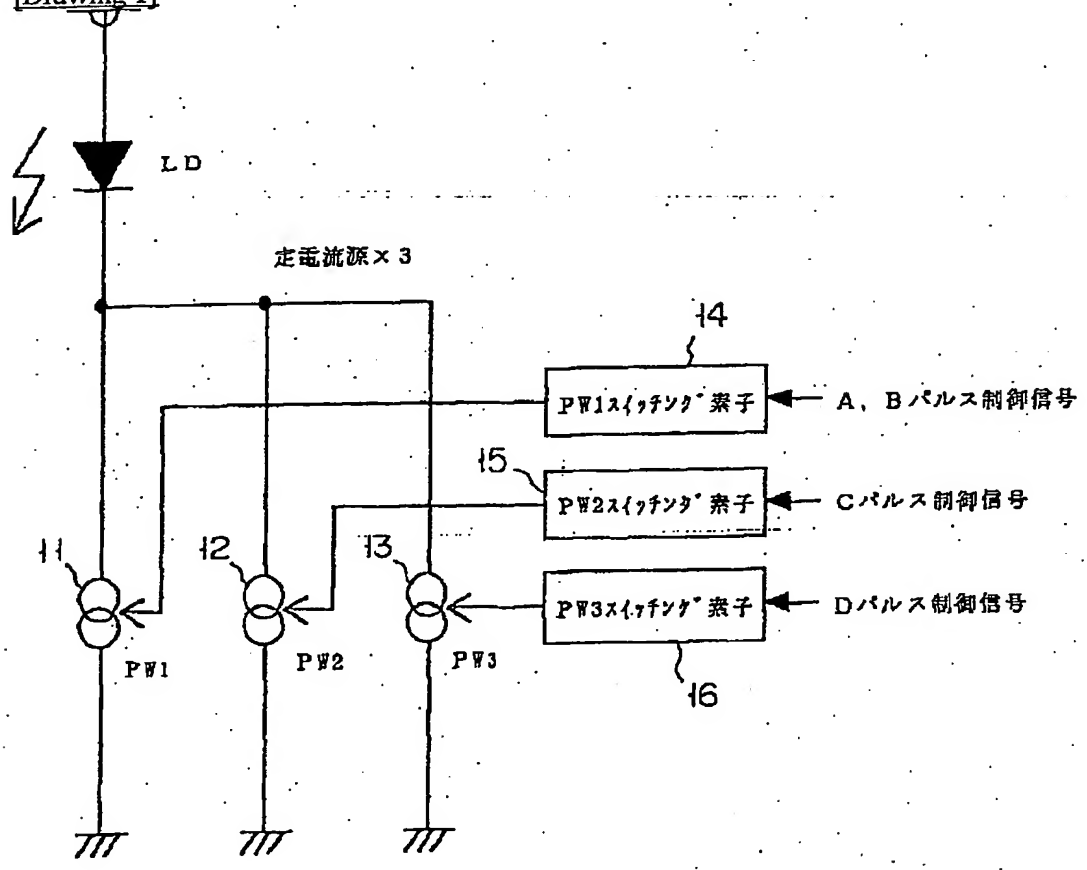
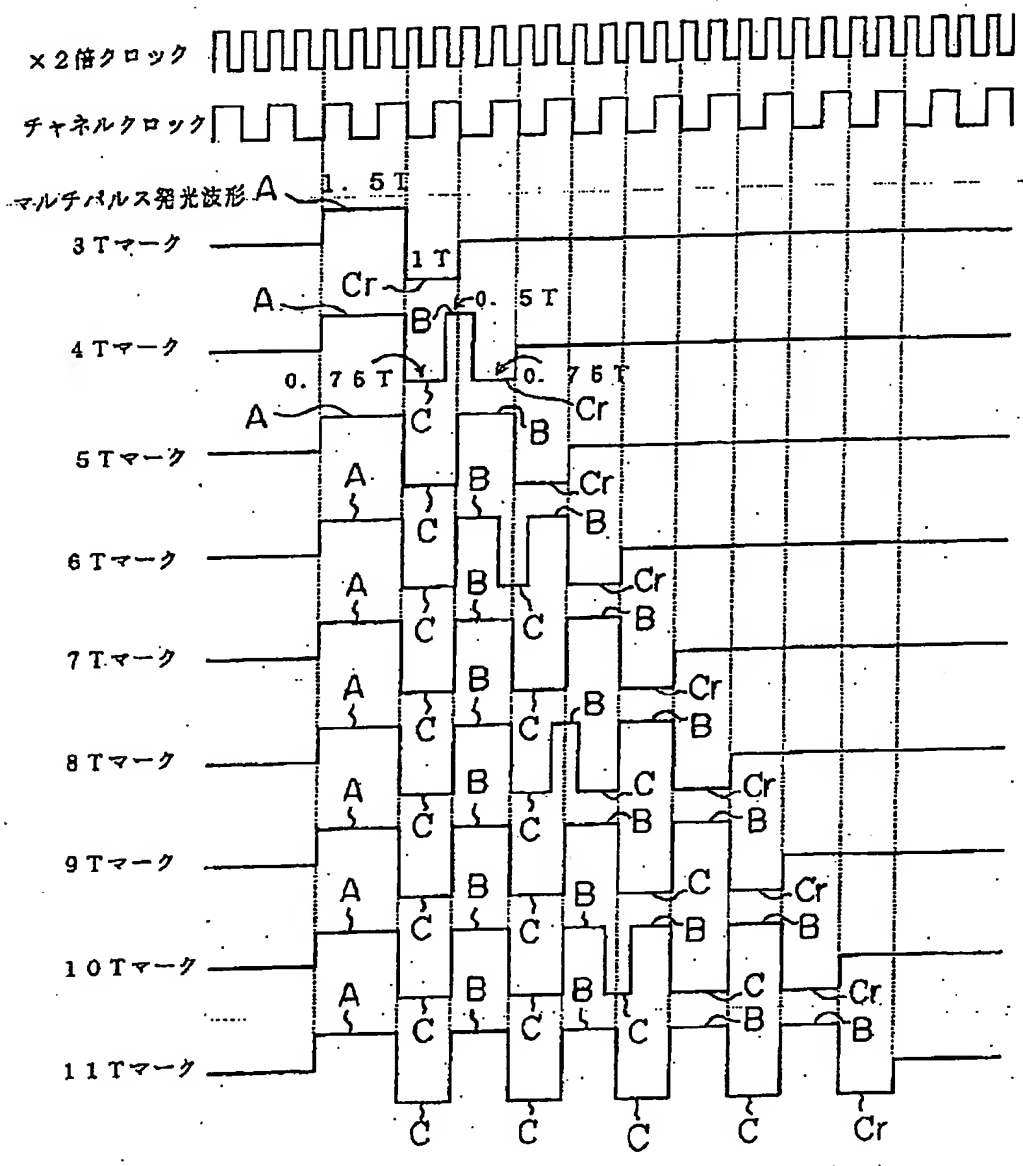
DRAWINGS

[Drawing 1]



[Drawing 2]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チャネルクロック
マルチパルス発光波形
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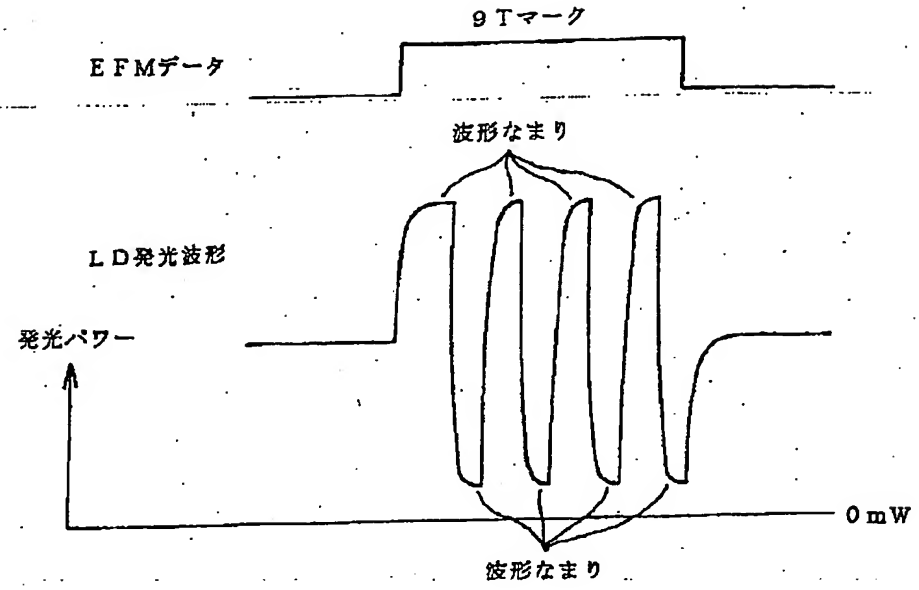
4Tマーク
5Tマーク
6Tマーク
7Tマーク
8Tマーク
9Tマーク
10Tマーク
11Tマーク
1.5T
1T
0.5T
0.75T
0.75T
A
B
C
Cr

[Drawing 3]

(a)



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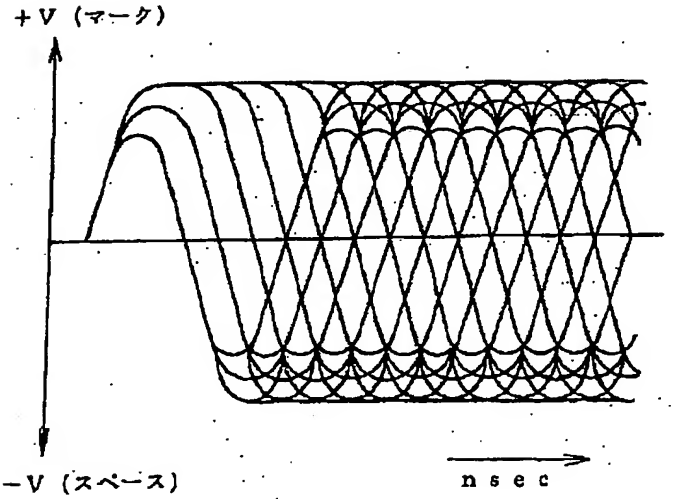

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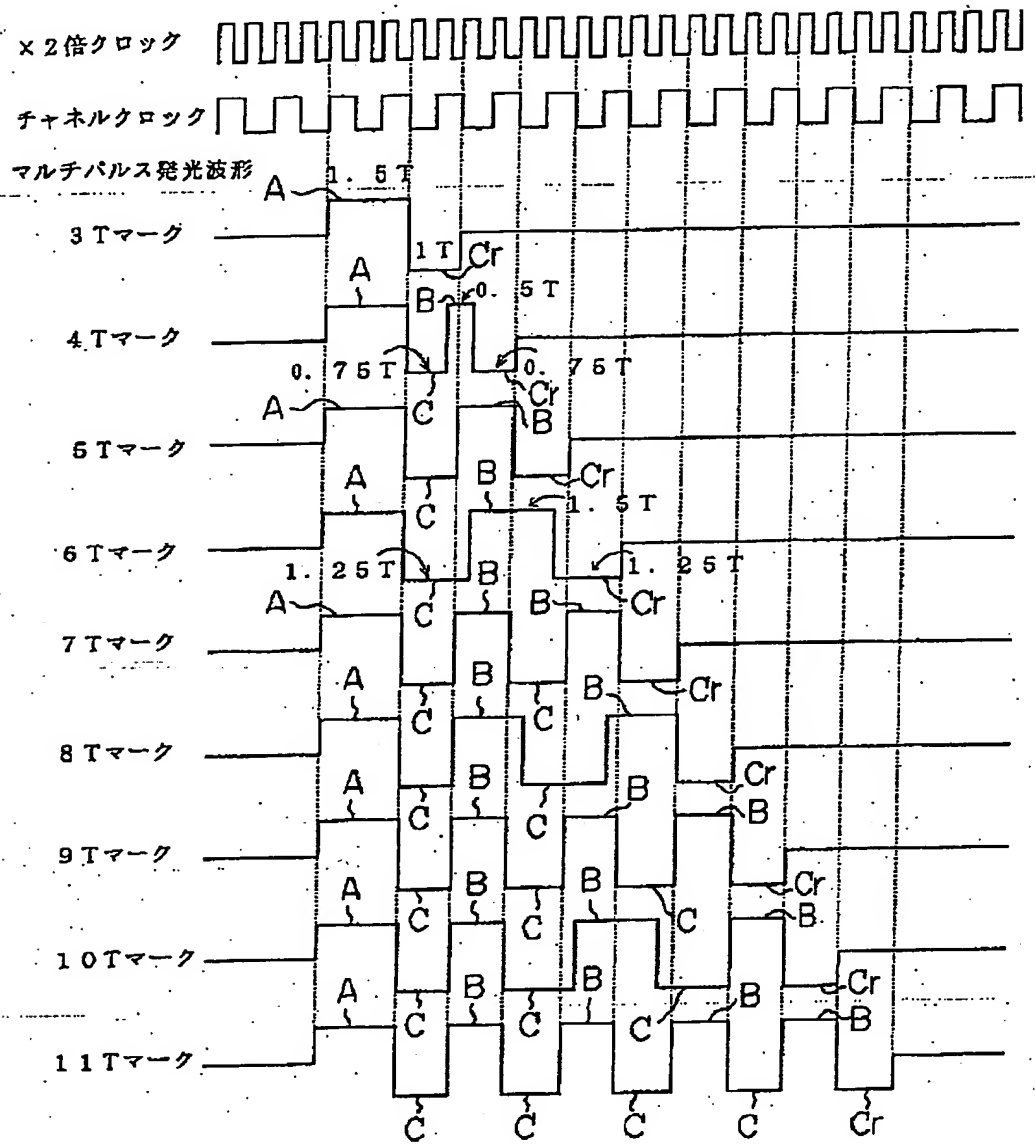
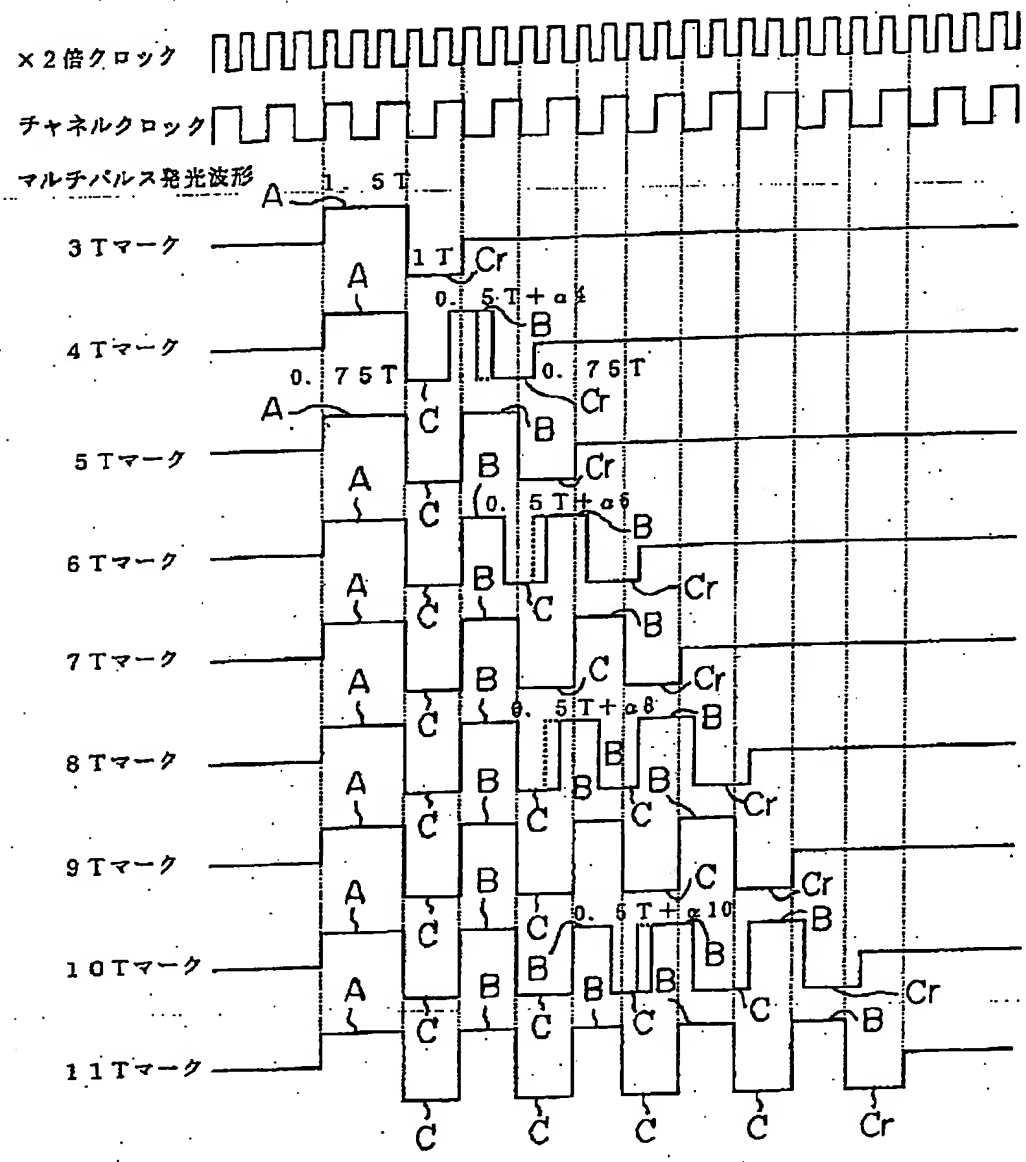

×２倍クロック
チャネルクロック
マルチパルス発光波形
３Tマーク
４Tマーク
５Tマーク
６Tマーク
７Tマーク
８Tマーク
９Tマーク
１０Tマーク
１１Tマーク
A
B
C
Cr
1.5T
1T
0.5T
0.75T
1.25T

[Drawing 5]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チャネルクロック
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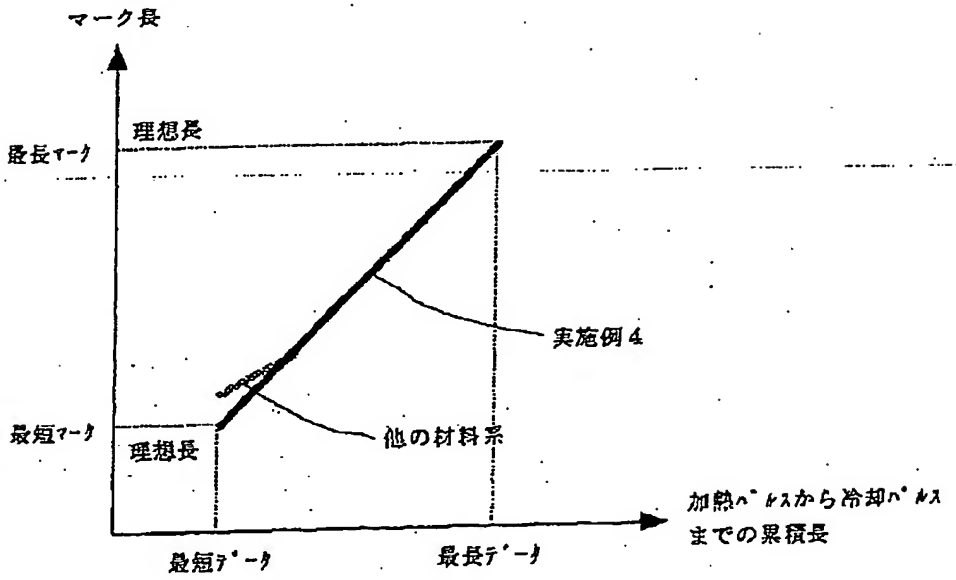
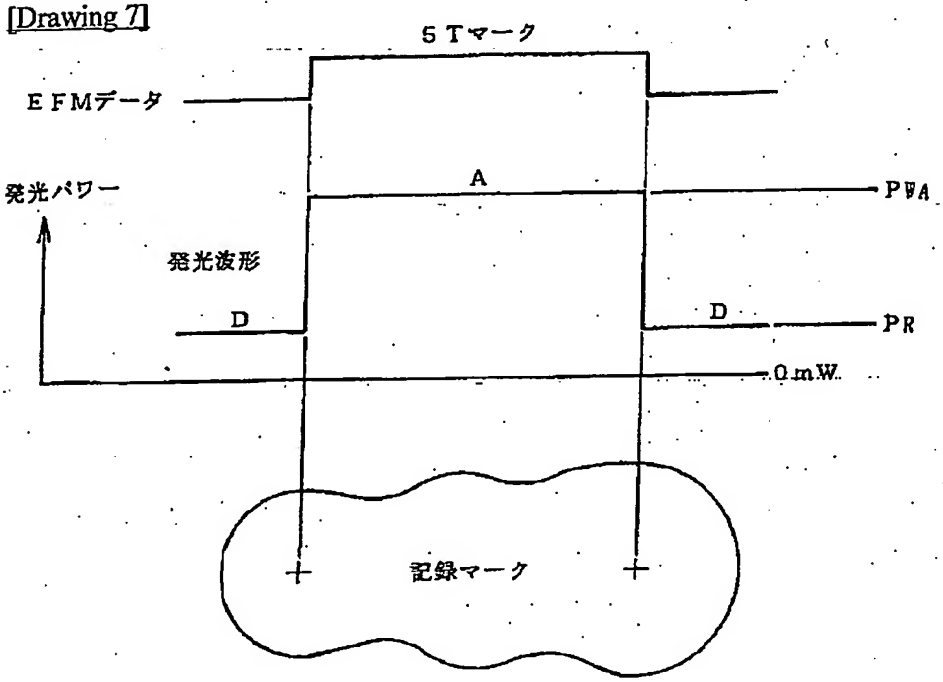
３Ｔマーク
４Ｔマーク
５Ｔマーク
６Ｔマーク
７Ｔマーク
８Ｔマーク
９Ｔマーク
１０Ｔマーク
１１Ｔマーク
A
B
C
Cr
1Ｔ
0.75Ｔ
0.5Ｔ+α4
0.5Ｔ+α6
0.5Ｔ+α8
0.5Ｔ+α10

[Drawing 6]



[Drawing 7]



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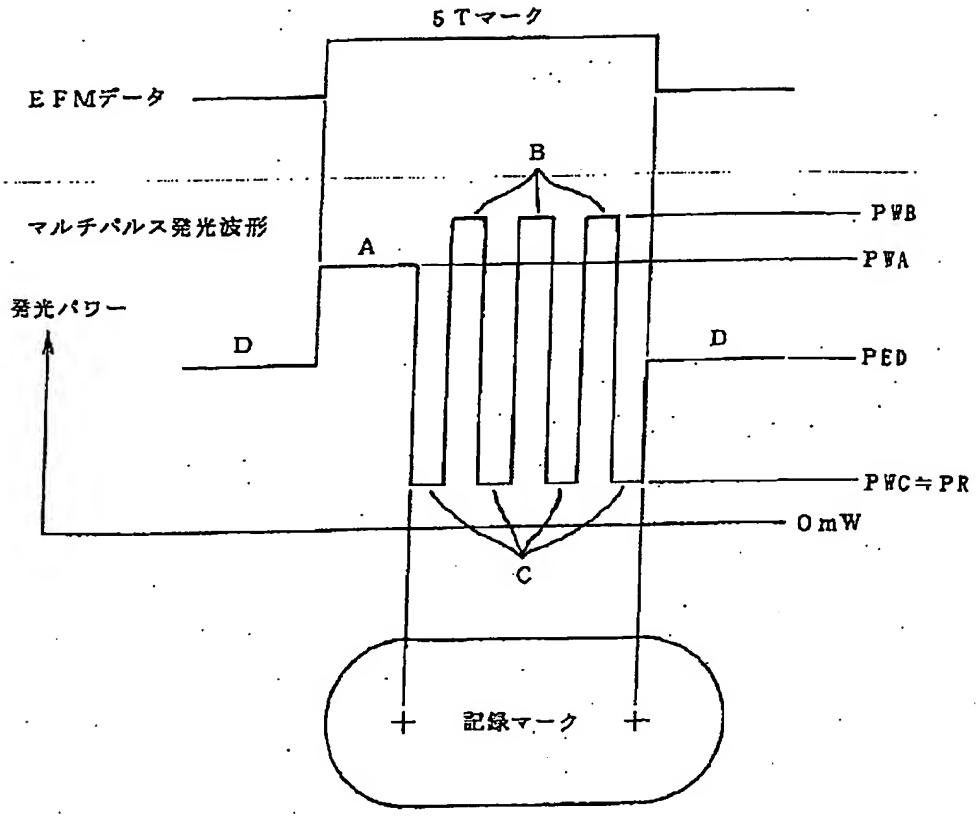
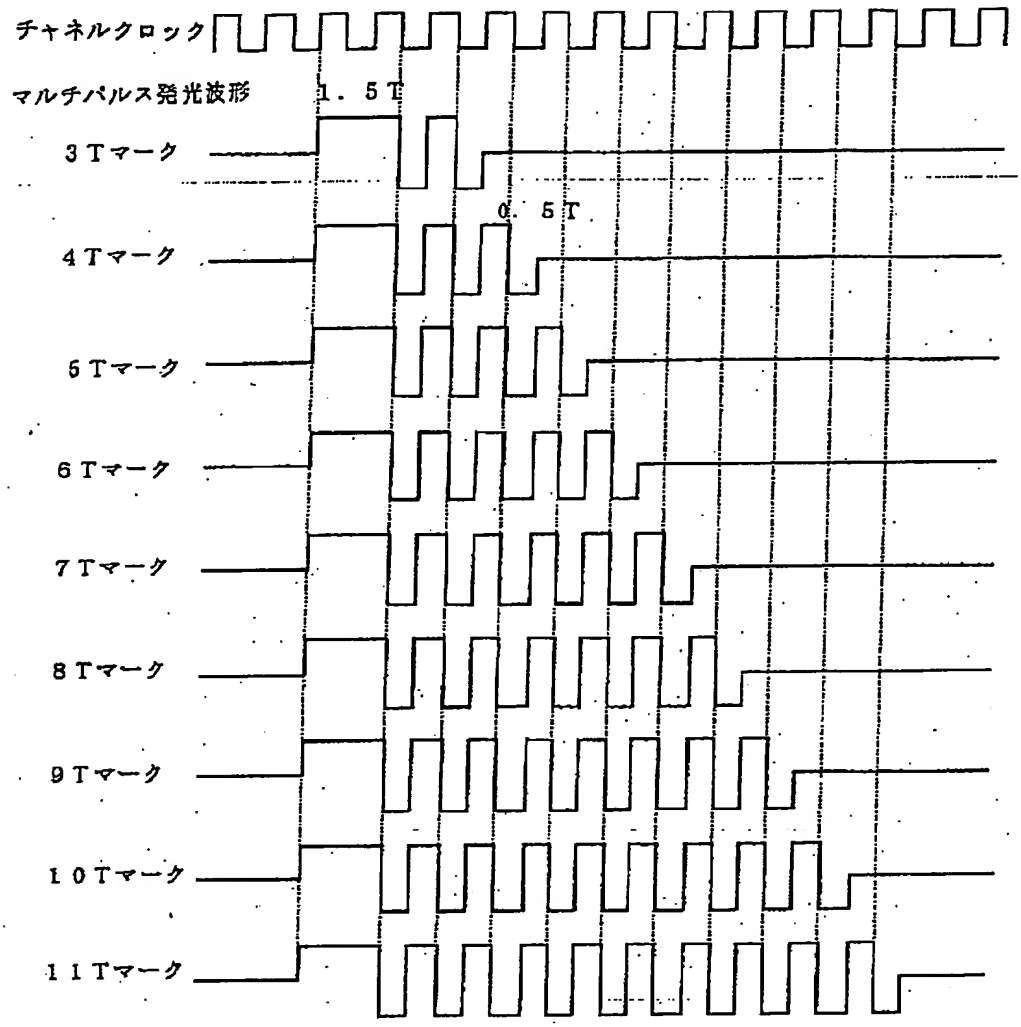
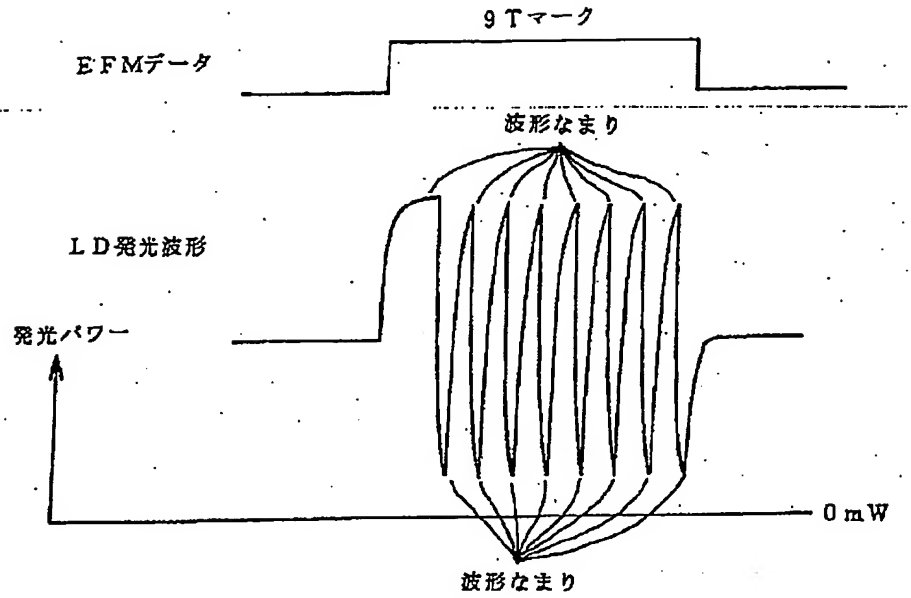

5Tマーク
EFMデータ
B
マルチパルス発光波形
PWB
A
PWA
発光パワー
D
D
PED
PWC≒PR
0mW
C
記録マーク

[Drawing 9]

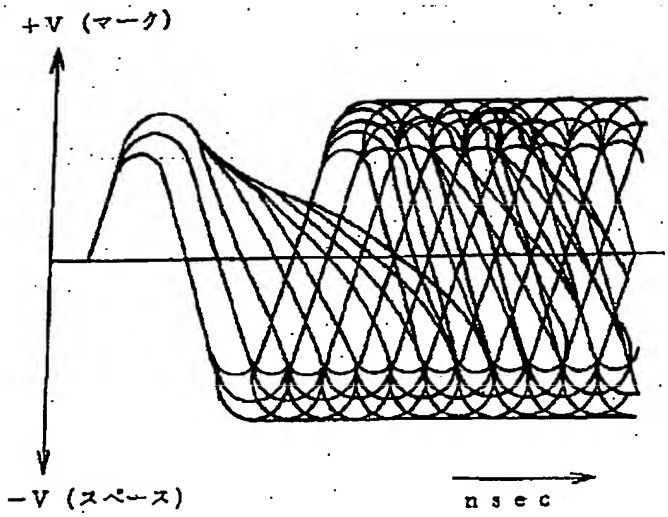

チャネルクロック
マルチパルス発光波形
1．5T
0．5T
3Tマーク
4Tマーク
5Tマーク
6Tマーク
7Tマーク
8Tマーク
9Tマーク
10Tマーク
11Tマーク

[Drawing 10]

(a)



(b)



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